

Newly recorded species of the genus *Isohypsibius* (Tardigrada; Hypsibiidae) from China

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Abstract: This paper reports two newly recorded species, *Isohypsibius lunulatus* Iharos, 1966 and *Isohypsibius prosostomus* Thulin, 1928, of the genus *Isohypsibius* (Tardigrada; Hypsibiidae) from China. The specimens of *Isohypsibius lunulatus* were collected from Taibai Mt (34°18'N, 107°42'E) at 2,500 m a.s.l. and those of *Isohypsibius prosostomus* from Taibai Mt (34°10'N, 107°35'E) at 2,000 m above sea level. All specimens are deposited at the College of Life Sciences, Shaanxi Normal University, China. A key to the Chinese species of *Isohypsibius* was also given.

Keywords: Tardigrada; Taxonomy; New record; China

Introduction

Over 118 species of the genus *Isohypsibius* have been described in the world (Guidetti & Bertolandi 2005). Up to now, however, only 14 species of this genus have been reported from China. In this paper, two newly recorded species, *Isohypsibius lunulatus* Iharos, 1966 and *Isohypsibius prosostomus* Thulin, 1928 were reported and figured. A key to the Chinese species of *Isohypsibius* was also given.

Materials and Methods

Tardigrades were extracted from mosses and lichens collected from Taibai Mt, Shaanxi Province. All specimens were mounted in Hoyer's medium on microscope slides and the coverslips were sealed with epoxy paint for identification. Observation and measurements were made using phase contrast microscopy (PCM) (Leica DM LB2) and an eyepiece micrometer. Photomicrographs were made using PCM associated with a digital camera (Leica DFC Twain 6.1.1). *pt* is the percent ratio of the length between a structure and buccal tube, which measured from the medio-dorsal transversal ridge to the base of the pharyngeal apophyses (Pilato 1981). The specimens are deposited at the College of Life Sciences, Shaanxi Normal University, China.

Taxonomic account

Class Eutardigrada Marcus, 1927

Order Parachela Schuster, Nelson, Grigarick, & Christenberry, 1980

Family Hypsibiidae Pilato, 1969

Genus *Isohypsibius* Thulin, 1928

Isohypsibius lunulatus Iharos, 1966

(Figs 1–3, Table 1)

Material examined: All specimens were collected from Taibai Mt (34°18'N, 107°42'E) at 2,500 m above sea level. All specimens are deposited at the College of Life Sciences, Shaanxi Normal University, China.

Description: Length up to 300µm (Table 1), colorless, eye spots present. Dorsum of the body with 10 transverse rows of large gibbosities, 3 gibbosities in row 1; 2 dorsolateral gibbosities in row 2; 3 gibbosities in row 3; 4 gibbosities in row 4, of which the internal ones smaller than the external ones; 3 gibbosities in row 5; 4 gibbosities equal in size in row 6; 3 gibbosities in row 7; 4 gibbosities in row 8, of which the internal ones larger than the external ones; 2 gibbosities in row 9; 3 gibbosities in row 10, of which the internal ones hemispherical, the external ones transversely elongated. 1 gibbosity present on lateral side of the hind legs. Cuticle on dorsal side of the body including the gibbosities was covered with densely distributed tubercles (Fig. 3).

Buccal apparatus of *Isohypsibius* type. Pharynx oval with robust apophyses and two elongated macroplacoids, the first macroplacoid with a middle constriction, longer than the second macroplacoid; microplacoid and septula absent (Fig. 1).

Claws of *Isohypsibius* type, the principal branch of the external claws with a basal portion more robust and a more sharpened distal portion, the secondary branch rather long. Accessory points present on the principal branches of the claws. Cuticular bars present on the first three pairs of legs. Lunules present on all legs (Fig. 2).

Remarks: *I. lunulatus* was firstly described from Hungary. Subsequently, it was reported from Sicily, Austria, Sweden,

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Greece, French, Spain, and Canada (Ramazzotti & Maucci 1983; Kathman 1990). It is the first report of this species from China.

Table 1. Measurements of *I. lunulatus*^Δ

Character	Max		Min		Mean ± SD (n=6)	
	μm	pt	μm	pt	μm	pt
Body length	302.0		208.0		256.33±14.26	
Buccal tube length	36.0		28.2		31.67±1.10	
Stylet support insertion point	24.8	68.85	18.8	66.68	21.75±0.88	68.62±1.82
Buccal tube width	2.9	7.97	2.4	8.34	3.00±0.17	9.5±1.39
1st macroplacoid length	5.0	13.77	5.0	17.60	5.13±0.09	16.32±1.64
2nd macroplacoid length	3.1	8.69	2.9	10.18	3.09±0.08	9.78±0.72
Placoid row length	9.4	26.10	9.4	33.36	9.83±0.14	31.24±2.83
Pharyngeal bulb length	33.9	94.20	28.2	100.04	31.41±1.01	99.52±8.55
Pharyngeal bulb width	24.0	66.67	22.2	78.74	24.1±0.83	76.59±9.52
Leg 1 external claw primary branch length	11.0	30.43	9.1	32.43	9.88±0.26	31.27±1.79
Leg 1 external claw secondary branch length	8.1	22.46	6.3	22.21	7.09±0.25	22.42±1.26
Leg 1 internal claw primary branch length	9.1	25.37	7.8	27.79	8.31±0.18	26.31±1.27
Leg 1 internal claw secondary branch length	6.8	18.85	5.5	19.45	5.96±0.18	18.84±0.83
Leg 2 external claw primary branch length	12.3	34.06	10.2	36.12	11.09±0.29	35.12±2.07
Leg 2 external claw secondary branch length	8.6	23.90	6.8	24.10	7.70±0.26	24.36±1.61
Leg 2 internal claw primary branch length	10.2	28.26	8.4	29.63	9.22±0.28	29.19±1.83
Leg 2 internal claw secondary branch length	7.6	21.02	6.0	21.29	6.57±0.23	20.77±1.2
Leg 3 external claw primary branch length	13.6	37.67	11.2	39.82	12.05±0.34	38.15±2.18
Leg 3 external claw secondary branch length	9.1	25.37	7.6	26.86	8.40±0.22	26.57±1.36
Leg 3 internal claw primary branch length	11.0	30.43	8.9	31.48	9.92±0.28	31.38±1.46
Leg 3 internal claw secondary branch length	8.1	22.46	6.5	23.17	7.14±0.22	22.58±1.15
External claw 4 primary branch length	14.4	39.87	12.3	43.54	13.05±0.32	41.32±1.96
External claw 4 secondary branch length	9.9	27.54	9.4	33.36	9.57±0.19	30.36±2.29
Internal claw 4 primary branch length	11.5	31.87	10.2	36.12	10.79±0.22	34.19±2.14
Internal claw 4 secondary branch length	8.4	23.18	7.3	25.94	7.83±0.18	24.81±1.62

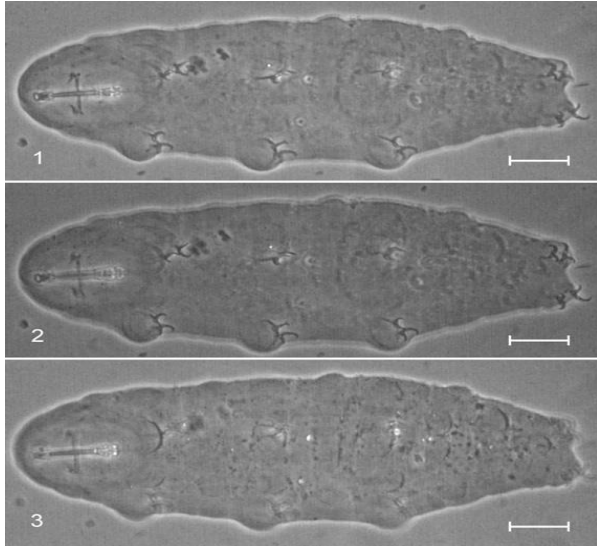
Δ Min, minimum; Max, maximum; SD, standard deviation.

Table 2. Measurements of *I. Prosostomus*[▽]

Character	Max		Min		Mean ± SD (n=6)	
	μm	pt	μm	pt	μm	pt
Body length	338		212		242.8±23.94	
Buccal tube length	29.5		23.0		26.36±1.11	
Stylet support insertion point	19.8	67.26	14.6	63.64	17.33±1.06	65.56±1.62
Buccal tube width	2.9	9.73	2.4	10.23	2.39±0.15	9.13±0.31
1st macroplacoid length	2.4	7.96	2.1	9.09	2.04±0.08	7.75±0.38
2nd macroplacoid length	2.9	9.73	2.4	10.23	2.45±0.09	9.33±0.25
3rd macroplacoid length	3.7	12.39	3.1	13.64	3.23±0.13	12.3±0.37
microplacoid length	1.0	3.54	0.8	3.41	0.83±0.08	3.18±0.37
Macroplacoid row length	13.6	46.02	10.7	46.59	11.48±0.53	43.63±1.28
Leg 1 external claw primary branch length	13.3	45.14	10.2	44.32	11.54±0.56	43.8±1.31
Leg 1 external claw secondary branch length	9.1	30.97	7.3	31.82	8.25±0.29	31.33±0.36
Leg 1 internal claw primary branch length	11.8	39.82	9.4	40.91	10.39±0.40	39.48±0.93
Leg 1 internal claw secondary branch length	8.1	27.43	6.3	27.27	7.05±0.31	26.75±0.56
Leg 2 external claw primary branch length	14.4	48.67	11.8	51.14	12.84±0.49	48.8±1.08
Leg 2 external claw secondary branch length	10.2	34.51	8.4	36.36	9.24±0.31	35.11±0.41
Leg 2 internal claw primary branch length	12.8	43.36	10.2	44.32	11.22±0.47	42.64±1.03
Leg 2 internal claw secondary branch length	8.9	30.09	6.8	29.55	7.73±0.35	29.33±0.74
Leg 3 external claw primary branch length	15.9	53.98	12.8	55.68	14.15±0.53	53.74±0.99
Leg 3 external claw secondary branch length	11.0	37.17	9.1	39.77	9.97±0.28	37.91±0.66
Leg 3 internal claw primary branch length	13.6	46.02	10.7	46.59	11.95±0.48	45.39±0.75
Leg 3 internal claw secondary branch length	9.4	31.86	7.3	31.82	8.35±0.34	31.7±0.39
Posterior claw 4 primary branch length	17.8	60.18	13.8	60.23	15.56±0.66	59.08±1.33
Posterior claw 4 secondary branch length	11.8	39.82	9.7	42.05	10.6±0.35	40.28±0.55
Anterior claw 4 primary branch length	14.4	48.67	11.8	51.14	12.84±0.45	48.8±0.98
Anterior claw 4 secondary branch length	10.2	34.51	8.1	35.23	8.98±0.35	34.12±0.53

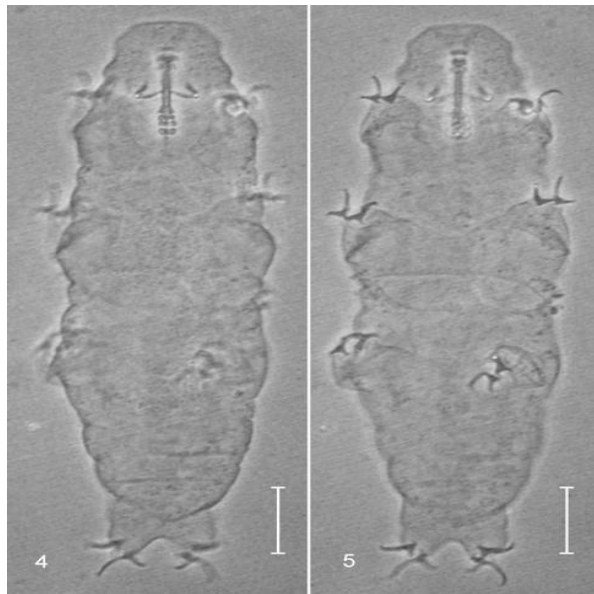
▽Min, minimum; Max, maximum; SD, standard deviation.

Isohypsibius prosostomus Thulin, 1928 (Figs. 4–5, Table 2)
Material examined: All specimens were collected from Taibai Mt (34°10'N, 107°35'E) at 2,000 m above sea level. All specimens are deposited at the College of Life Sciences, Shaanxi Normal University, China.



Figs. 1–3 *Isohypsibius lunulatus* Iharos, 1966

1. Habitus focused to show the bucco-pharyngeal apparatus;
2. Habitus focused to show the double claws;
3. Habitus focused to show the gibbosities and cuticular sculpture. 1–3. Scale bars = 40µm.



Figs. 4–5 *Isohypsibius prosostomus* Thulin, 1928

4. Habitus focused to show the bucco-pharyngeal apparatus;
5. Habitus focused to show the double claws. 4–5. Scale bars = 40µm

Description: Length from 200 to 450µm (Table 2), colorless, eyes spots present, cuticle smooth.

Buccal apparatus of *Isohypsibius* type. Buccal tube with diameter of 3–5µm. Pharynx oval with apophyses, 3 macroplacoids and a microplacoid; the first macroplacoid in contact with the

apophyses, the first two macroplacoids equal in length and almost contacted with each other, the third macroplacoid longer than the first two. Septula absent (Fig. 4).

Claws of *Isohypsibius* type, the internal claws in size and shape differs from those of the external on all legs; the principle branch of the external double claws with two small accessory points, much longer and slender than the secondary branch. Cuticular bars present on the first three pairs of legs (Fig. 5).

Remarks: *I. prosostomus* is a common species. It was found from a variety of localities in the world (Ramazzotti & Maucci 1983). It is the first report of this species from China.

Key to the Chinese species of *Isohypsibius*

1. Cuticle smooth, without sculpture, reticular structure, or gibbosities.....2
Cuticle sculptured, with reticular structure, and/or with gibbosities.....7
2. Lunules present at the base of claws.....3
Lunule absent.....5
3. Pharynx with three macroplacoids4
Pharynx with two macroplacoids*I. borkini*
4. Cuticular bars present only on the first three pair of legs.....*I. taibaiensis*
Cuticular bars present on all of legs.....*I. macrodactylus*
5. Cuticular bars present near the internal claws.....*I. prosostomus*
Cuticular bars absent.....6
6. Pharynx with microplacoid.....*I. stenostomus*
Pharynx without microplacoid.....*I. tetradactylodes*
7. Pharynx with three macroplacoids8
Pharynx with two macroplacoids12
8. Gibbosities absent.....9
Gibbosities present.....11
9. Lunule present at the base of claws.....*I. jingshanensis*
Lunule absent.....10
10. Cuticle with reticular sculpture.....*I. liae*
Cuticle with large poriform sculpture.....*yunnanensis*
11. Dorsum with ten transverse rows of gibbosities, cuticular bars
Present.....*I. rahmi*
Dorsum with nine transverse row gibbosities, cuticular bars
Absent.....*I. vietnamensis*
12. Dorsum without gibbosities.....*I. changbaiensis*
Dorsum with gibbosities.....13
13. Lunule present at the base of claws.....14
Lunule absent.....15
14. Cuticular bars present near the internal claws.....*I. tuberculatus*
Cuticular bars absent.....*I. satteri*
15. Papilla present on the lateral sides of the body.....*I. lunulatus*
Papilla absent on the lateral sides of the body.....*I. qinlingensis*

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